

# **Cambridge area test results:**

## **1. Summary**

Cambridge Positioning Systems Ltd (CPS) has thoroughly tested its E-OTD solution in Cambridge, UK. We have a test configuration involving 107 test locations spread across a 200 square km area of the city, and comprising a variety of terrains (rural, suburban, city-centre, light industrial areas). Despite a sub-optimal set-up, the results indicated that 67 % of the measurements were within 65.4 metres of the true position, and 95 % were within 122.9m. Applying a technique known as Multiple Location Requests (MLR) combining 4 requests, the results improved further to 45.8 m and 91.8 m respectively. MLR is only one of the accuracy-enhancing techniques identified by an industry-led group to meet the FCC E-911 2003 requirements.

To confirm these MLR improvements similar measurements were taken from sites in the US with Detroit and Denton both yielding 67% figures of 61m. These measurements were undertaken in 2002 and CPS feel that given the time remaining to meet the FCC 2003 requirements the performance of EOTD will improve and exceed these requirements.

## **2. Introduction**

CPS provides an E-OTD processing core that is licensed to GSM equipment vendors including Ericsson, Nortel and Siemens that deliver E-OTD systems to their customers. These manufacturers have deployed their E-OTD positioning systems in trials with North American GSM operators T-Mobile, Cingular and AWS. They have demonstrated accuracies within the FCC 2002 requirement of 67 % of the calls within 100 m and 95 % within 300 m. An industry-wide initiative focussed on meeting the 2003 requirements of 50m and 150m has identified a number of enhancements to the current technology. One of the key techniques is the combining together of measurements made by the handset during the first thirty seconds of the emergency call, as permitted by the FCC rules set out in its document [ref. OET 71]. CPS has tested this using data taken during a trial of its system in Cambridge in 2002, the results of which are presented here. The E-OTD system will operate by making available updated, and increasingly accurate, position information throughout the emergency call.

### 3. The Trial area

Cambridge has a population of around 115,000, and includes large areas of suburban housing similar in character to that found in most American cities. It also has a densely packed city centre of narrow streets between five-story brick and stone buildings, light industrial areas, English village fringes, and is set within a rural landscape. The trial was comprehensive and encompassed all environment types, and was therefore representative of the full range of radio environments of a typical American deployment, except for the 'down-town' areas of closely spaced skyscrapers.

### 4. The trial method

Testers were deployed simultaneously at 107 outdoor locations whose positions had previously been determined to within 10m, as shown below.



The handsets were held as in normal operation and set to report E-OTD measurements. Timing measurements were also made by 11 LMUs deployed across the area that reported on 81 BTS cells in and around Cambridge. The LMU network was not optimally deployed in that (a) the LMUs were not co-located with BTSs as in a commercial installation so direct sampling of the transmitted signals using internal connections was not possible, and (b) the 'absolute' timing mode (ATD) of E-OTD using GPS referenced clocks was not available. It should also be noted that SMS was used to transfer data from both handsets and LMUs, with consequent large and variable uncertainties in time stamping. In addition the handsets did not have the benefit of assistance data as would be available in the commercial systems. The handset version used in the trial has since been shown to have a problem associated with the accuracy of its E-OTD measurements.

Data was collected by the SMLC and processed to provide locations both for each individual measurement report, and for a combination of four successive reports from the same test point. Although the latter analysis combined together measurements made at 1-minute intervals, CPS has confirmed that the same data can be acquired within 30 seconds so that combining in this way produced results representative of those which shall be achieved in future tests when the multi-transaction capability has been included. In addition data was also combined together using 6 successive measurements. This 6 measurement processing uses information that represents data that could be acquired by more modern handset platforms within the 30 seconds available.

## 5. The results

The results of the trial are shown below.

Cambridge	No. of EOTD calculations	Within 67%	Within 95%	Yield
Each report separate	435	<b>65.4m</b>	122.9m	99.8
Four reports combined	435	<b>50.2m</b>	96.4m	100
Six reports combined	435	<b>45.8m</b>	91.8m	100

It can be seen that the results for the calculations based on individual reports are well within the 2002 accuracy requirements. Indeed, the result for the 95 % limit already exceeds the 2003 requirement. When data from four reports are combined in one overall position calculation, representative of the amount of data that will be measured during the first 30 seconds of the 911 call, the 95 % limit exceeds the 2003 requirement by a large margin, and the 67 % limit is within 20cm. When six measurements are combined, representative of what can be collected within 30 seconds for the more modern handset platforms, the 2003 requirements are exceeded. It should also be noted that the yield, the number of

E-OTD location attempts compared to the successful location calculations, rapidly reaches 100 %.

## **6. Conclusion**

This trial has shown that E-OTD can today approach the 2003 FCC E-911 accuracy requirements for handset-based solutions when deployed across a typical city. CPS strongly believes that further improvements will bring EOTD within the 2003 requirements in the timeframes required.